

BASIS FOR AMENDMENTS TO CLAIMS

Applicants have added new Claims 36 and 37 which require that the phenolic resin melting point is below about 120°C. Basis for this amendment is contained on page 10, lines 4 - 7 of the application.

Minor amendments were made to the preamble of Claims 32 - 35 to correct obvious errors.

No new subject matter is introduced by the addition of these amendments or these new claims.

Discussion

The USPTO rejected a number of the claims of the application under 35 U.S.C. § 103 as being unpatentable over Robins, U.S. Patent No. 3,409,579 ("Robins") and a "Translation from Roempp's Chemie Lexikon (10th Edition)" ("Roempp") and further in view of Saeki, et al., U.S. Patent No. 4,426,484 ("Saeki"). The USPTO also rejected several claims as being unpatentable over Robins, Roempp, Saeki and further in view of El-Demallawy, et al., (U.S. Patent Application 2003/0183364) ("El-Demallawy"). Finally, the USPTO rejected Claims 6 and 7 under 35 U.S.C. §103 as being unpatentable over Robins, Roempp, Saeki and further in view of Miki, U.S. Patent No. 6,372,032 ("Miki"). Applicants respectfully traverse these rejections.

Present Invention

The present invention pertains to a process for producing shaped bodies, which process comprises preparing a composition comprising blending a phenolic resin, in solid form, a polyisocyanate and a refractory material at a temperature below the melting point of the phenolic resin, molding said composition to form a shaped body, and raising the temperature of the shaped body to a temperature above

the phenolic resin melting point for curing the composition. After having reached a temperature above the phenolic resin melting point, the solid resin melts and as a liquid component undergoes a rapidly proceeding addition reaction with the polyisocyanate yielding a polyurethane, which acts as a binder between the refractory material particles (Application, p. 12, lines 7 to 12).

In particular, the process of the present invention provides an advantage of allowing the curing of shaped bodies at a point in time to be chosen by a skilled person and thereby provides a processing time interval of sufficient length (Application, p. 12, lines 16 to 24). As outlined in more detail in the Amendment filed on January 30, 2009, the process of the present invention provides shaped bodies having a high strength, a low hot deformation, a low smoke evolution during casting, as well as a low odour formation of the shaped bodies during storage (Application, p. 22, line 31 to p. 28, line 20). Additionally, the present invention provides for a low emission of pollutants, as well as a low gas and condensate formation and may thereby reduce problems caused by gas porosity (Application, p. 17, lines 9 to 35).

**Analysis of rejection based on Robins, Roempp, and
Saeki, et al.**

Robins discloses binder compositions comprise organic solvent solutions of a specific non-aqueous phenolic resin, a hardener component, comprising liquid polyisocyanate, and a curing agent, comprising a tertiary amine. (Col. 3, lines 3 - 55)

As acknowledged by the Examiner, Robins fails to disclose the feature of a phenolic "resin in solid form" as set forth in present independent Claims 1 and 19, (Office Action, p. 3, para. 2) and also fails to disclose the step of preparing a composition comprising blending a phenolic resin in solid form, a polyisocyanate, and a refractory material at a temperature below the melting point of the phenolic resin, as set forth in present independent Claim 1 (Office Action, p. 2, last para. to p. 3, line 1).

The Examiner does not assert there is a disclosure of these features in Roempp. Applicants assert that these features may also not be derived from Saeki.

Saeki mentions that for specific foundry application processes, such as, in particular, hot mulling, phenolic

resins are required to be solid at ambient temperature (Saeki, Col. 1, lines 14 to 19). Yet Saeki fails to explain the reasons for this requirement and neither teaches, nor suggests a step of preparing a composition comprising blending a phenolic resin in solid form, and a polyisocyanate, and a refractory material at a temperature below the melting point of the phenolic resin.

To the contrary, according to the hot mulling process disclosed in Saeki, silica sand is heated to 130 to 135°C and subsequently blended with a resol type phenolic resin. As a result of the process taught by Saeki, "*shell molding resin coated sand*" is obtained. This disclosure inevitably implies that during the blending step, said phenolic resin must have been present in molten form for coating the sand (Saeki, Col. 4, line 65 to Col. 5, line 4).

Additionally, Saeki teach a chemical reaction, namely a polymerization reaction on the basis of a phenolic resin in the absence of a polyisocyanate, which reaction is different from the reaction taught by the present invention and taught by Robins, namely an addition reaction on the basis of a phenolic resin and a polyisocyanate. The reactions of Saeki and both the Robins reference and the present invention should therefore be regarded as being incompatible. Due to

these fundamental differences with respect to the chemical reactions underlying the process of Robins and Saeki, the reference Saeki should not be considered as providing any teaching, suggestion, or motivation for combining said reference with or modifying the teachings of Robins.

Moreover, Saeki teach that known polymerized phenolic resin compositions are associated with considerably drawbacks, namely with a slow curing rate (Saeki, Col. 1, lines 39 to 40) or the emission of toxic gases (Saeki, Col. 1, lines 20 to 26) and advises that known polymerized phenolic resin compositions on the basis of solid phenolic resin provide final products having insufficient mechanical strength and insufficient hardness (Saeki, Col. 2, lines 7 to 9). According to Saeki the before-mentioned drawbacks of polymerized phenolic resin compositions of the state of the art have to be obviated by adding specific amounts of resorcinol type resins (Saeki, Col. 2, lines 11 to 19). The passage cited by the Examiner disclosing an accelerated curing rate, as well as heat cured articles of excellent mechanical strength and hardness refers only to polymers obtained by polymerizing a solid resol type phenolic resin and a resorcinol resin (Saeki, Col. 3, lines 13 - 20), but not to polymers on the basis of phenolic resins in general,

i.e. to polymers polymerized in absence of resorcinol resin.

Thus, Saeki teaches away from the use of phenolic resin compositions in general, i.e. in absence of resorcinol resin, for producing shaped bodies. A skilled person may be expected not to replace arbitrarily components taught in the references Saeki and Robins, while omitting an addition of resorcinol resin, i.e. a component necessary for obtaining shaped bodies with sufficient material properties that is required by the references.

In summary, Saeki fail to provide any teaching, suggestion, or motivation for combining or modifying the teachings of Robins and Roempp. What is more, even when Saeki, Robins and Roempp are combined, such a combination or modification fails to disclose all features of the present claims.

Additionally, it should be respectfully submitted that the step of preparing a composition comprising blending a phenolic resin in solid form, and a polyisocyanate, and a refractory material at a temperature below the melting point of the phenolic resin is not obvious for a skilled person. Rather to the contrary, a skilled person starting from the general knowledge in the art would rather provide the polymer components in form of a solution or in liquid/molten

form in order to obtain a very intimate mixture of said polymer components before filling said mixture in a mold. In particular, a skilled person would not have expected that a composition on the basis of a solid phenolic resin, filled in a mold and subjected to a heating step would provide cured shaped bodies of acceptable quality. Applicants have surprisingly discovered that this combination actually provides cured shaped bodies of superior quality.

In addition, as previously asserted, Robins does not disclose or suggest raising of the temperature of a shaped body in order to cure the composition, but rather teaches a gassing procedure to be preformed at room temperature in order to cure the composition. As outlined before, Robins explicitly aims at providing binder compositions characterized by their ability to rapidly cure at room temperature (Robins, Col. 2, lines 43- 47).

Further, Robins asserts that methods comprising a heating step forms part of the disadvantageous state of the art and thus, teaches away from the claimed processes wherein the temperature is raised for curing a binder composition. In particular, this applies with respect to the passage cited by the Examiner teaching that "*Considerable heating is required to cause the novolac resins to become*

cross-linked." (Robins, Col. 3, lines 23 to 24). Contrary to the assumption of the Examiner, this passage does not describe the invention taught in the Robins reference, but merely reflects the properties of phenolic novolac resins of the state of the art polymerized in absence of polyisocyanate (Robins, Col. 3, lines 17 to 34). As explained in more detail in Robins, the use of such phenolic resins polymerized in absence of polyisocyanate is associated with considerable drawbacks, since in case of novolac resins, a formaldehyde source has to be added and since in case of resole resins merely "*less suitable (...) binder compositions*" which "*normally contain large quantities of water*" (Robins, Col. 3, lines 20 to 31) may be obtained. Also, the passage cited by the Examiner, wherein it is stated that "*heating has generally been employed to cause the isocyanate to react with the phenolic resin*" (Robins, Col. 3, lines 8 to 13), is merely a comment with respect to the disadvantageous compositions of the state of the art and does not form part of the teachings of the invention of the Robins reference providing binder compositions characterized by their ability to rapidly cure at room temperature (Robins, Col. 2, lines 43 to 47 and Col. 3, line 14 to 16).

In addition, Roempp merely pertains to the polymerization of the curing of phenolic resins in absence of polyisocyanate and fails to provide any information with respect to a composition comprising a phenolic resin and a polyisocyanate and a refractory material, as set forth in the present independent Claims 1 and 19. As should be acknowledged, the curing temperatures to be applied for different types of polymer may differ and consequently, a skilled person would not refer to Roempp, i.e. a document concerned with a different types of polymer, in order to modify the curing temperature as taught in the Robins reference, i.e. room temperature.

With respect to the subject-matter of present Claims 2 and 23, Robins merely discloses a sequential addition of the respective components, but fails to disclose or to suggest the specific addition sequence as set forth in present Claims 2 and 23.

With respect to Claim 7 and 18, Robins merely pertains to a binder wherein the resin component comprises an organic solvent, and as also explicitly discloses in passages preceding the passages of the Robins reference cited by the Examiner, namely Col. 3, lines 51 to 53, and Col. 6, lines 21 to 49 and Col. 7, lines 6 to 9.

With respect to the subject-matter of present Claims 11 and 30, Robins fails to disclose or suggest the specific combination of diphenylmethane diisocyanate in admixture with its higher homologues, as set forth in said claims.

With respect to Claim 15, the passage cited by the Examiner (Robins, Col. 1, lines 60 to 64) merely pertains to the preparation of educts to be used in the present invention, i.e. novolac resins, but fails to provide any information with respect to the process for forming shaped bodies of the present invention.

With respect to Claims 31 and 35, due to the introduction of this additional feature, the present invention explicitly provides an absolute upper temperature limit to be observed, i.e. 120°C, during the step of preparing a composition comprising blending a solid novolak resin, a polyisocyanate and a refractory material. As should be acknowledged, a composition preparation step carried out at a temperature below the melting point of the novolak resin - and thus below 120°C - is neither disclosed, nor suggested in any of the references cited.

Please note also, Applicants' comments concerning the impropriety of the rejection even under KSR as discussed on page 18 through 19 of the prior Amendment, filed on January

30, 2009. Specifically, see Ex parte Whelan, 89 USPQ 1078, 1084 (2008).

With regard to the rejection based on Robins, Roempp, Saeki, El-Demallawy and further in view of Miki, see the discussions on pages 19 through 21 of the prior Amendment, filed on January 30, 2009, which comments are incorporated herein.

With respect to the subject-matter of the two newly introduced claims, Claims 36 and 37, said claims include a melting point temperature limit characterizing the solid phenolic resin. Due to the introduction of this additional feature, the present invention explicitly provides an absolute upper temperature limit to be observed, i.e. 120°C, during the step of preparing a composition comprising blending a solid phenolic resin, a polyisocyanate and a refractory material.

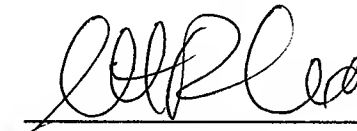
As should be acknowledged, a composition preparation step carried out at a temperature below the melting point of the phenolic resin - and thus below 120°C - is neither disclosed, nor suggested in any of the references cited. Moreover, none of the references cited gives any indication that a composition comprising a solid phenolic resin having a melting point below 120°C in combination with a

polyisocyanate and a refractory material provides superior properties for producing shaped bodies.

CONCLUSION

Applicants believe that all claims are now in condition for allowance and request the issuance of a Notice of Allowance. If there are any issues, please contact Applicants' counsel.

Respectfully Submitted,



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CERTIFICATE OF EFS SUBMISSION (37 C.F.R. § 1.8(a)(i)(1)(C))

I hereby certify that, on the date shown below, this correspondence is being submitted to the Patent and Trademark Office via the Office Electronic Filing System in accordance with § 1.6(a)(4).

Date: June 16, 2009

Holly Hart
Signature